A-1 Agricultural Project, individual application

A-2 Reduction in Sacramento River Diversions, directly addressing CALFED Quantifiable Objective 57 and providing insight and potential for addressing Quantifiable Objective 65, by pumping of existing groundwater wells. Data collection and analysis is proposed to gain knowledge on the interaction of surface and groundwater.

A-3 - A-8

Natomas Central Mutual Water Company
2601 West Elkhorn Boulevard
Rio Linda, CA 95673
Telephone: 916/419-5936
Fax: 916/419-8691
Email: NatomasH20@AOL.COM

Project contact person:
Name: Peter J. Hughes
Title: General Manager
Email: NatomasH20@AOL.COM

A-9 The total funds being requested for this project is $1,005,000.00

A-10 The applicant=s staff will provide in-kind services estimated at $120,000.00. In addition, 25,000 AF of the reduced diversions will be available to flow into the Delta for environmental benefit.

A-11 Duration of project: July of 2001 (when funds from this grant become available) through April of 2003.

A-12 California Assembly Representative: Dave Cox, District No. 5
California Senator Representative: Deborah Ortiz, District No. 6
Congressional District: Doug Ose, District No. 3

A-13 Natomas Central Mutual Water Company (Natomas) covers approximately 36,000 acres in the American Basin which is located approximately five miles north of downtown Sacramento. The Company is bordered by the Sacramento River to the West, Natomas Cross Canal to the North, the East Main Drain to the East and the American River at the Southern boundary. This area represents a portion of the CALFED Sub-Region 7.

A-14 By signing below, the applicant declares the following:
-The truthfulness of all representations in the proposal
-The individual signing the form is authorized to submit the application on behalf of the applicant
-The applicant will comply with contract terms and conditions identified in Section 11 of this PSP

_____ _____

Authorized Representative: (Printed) Date

_____

Peter J. Hughes (Signature)

B-1 Description of the Project

The proposed project results from recognition of the nature of groundwater conditions beneath the Natomas area (i.e., the occurrence of long term relatively constant, high groundwater levels as a result of minimal historical development and beneficial use of groundwater). The proposed project would allow Natomas the opportunity to develop and use groundwater on overlying lands conjunctively while reducing Natomas= surface water diversions from the Sacramento River. While the Natomas project is consistent with all the CALFED guiding principles, the proposed project directly addresses CALFED=s Quantifiable Objective 57 and is to evaluate local conjunctive use potential and associated impacts for future long-term benefits. Specifically, the Natomas project will make use of existing facilities to pump about 20,000 AF of groundwater and allow an equivalent amount of surface water to remain in the river for flow into the Delta. This will provide both quantity and quality benefits which are part of the quantifiable objectives for the Sacramento River and Delta. At the same time, the Natomas project will focus on a key impact issue; the potential of pumping surface water via groundwater pumping in close proximity to the Sacramento River. Although other, more common impacts, such as third-party well and pump performance impacts, will also be monitored and mitigated as appropriate, Natomas recognizes the unique issue of conjunctive use pumping and resultant stream-aquifer interaction as a critical potential impact and possibly a constraint to implementation of conjunctive use operations near the river (e.g., in Natomas as well as in numerous other areas within the Sacramento Valley). Thus, Natomas proposes this demonstration and test program which will allow Natomas to use its ground and surface water supplies more efficiently, reducing its surface water diversions from the Sacramento River, to the benefit of the Delta, and to observe and analyze the impacts of pumping on the stream-aquifer system.

In light of the preceding, this application can be considered for modifications to Natomas= facilities to facilitate more efficient use of its ground and surface water supplies. In order to field test the stream-aquifer interconnection, Natomas has identified a network of 13 wells with a combined pumping capacity of 26,000 gpm (58 cfs). Pumped over an eight month period (March through October) of rice pre-irrigation, irrigation and reflood for decomposition, can substitute nearly 20,000 AF of groundwater for the normal surface water supply from the Sacramento River. Based on limited hydrogeologic information, Natomas believes that such pumping will not interrupt or directly induce inflow from the river. However, due to a lack of focused study on that question to date, the pumping of those wells in 2001 and 2002 will be coupled with well and aquifer testing, groundwater level monitoring, groundwater quality sampling and analyses, and geologic descriptions of the stream-aquifer system to assess the existence and magnitude of river impacts. If such impacts occur, the well field is configured to interpret whether measures, such as depth limitations on wells and/or spacing requirements from the river, can be introduced to mitigate stream impacts and allow ongoing conjunctive use with one of its intended benefits, increased downstream flow to the Delta.

In summary, this proposed project involves three major tasks, each with subtasks:

- Initial test of groundwater pumping of approximately 5,000 AF in 2001 and leaving an equivalent volume in the Sacramento River for flow to the Delta.
- Demonstration and test of groundwater pumping of approximately 20,000 AF in 2002 and leaving an equivalent volume in the Sacramento River for flow to the Delta. This will be combined with monitoring and testing to observe basin response to pumping as well as third-party impacts and to focus on the question of groundwater pumping impacts on river flow.

- $ Final report developed in conjunction with local, State and Federal agencies input which will identify the potential for wet, normal and dry year yields.

B-2 Local, Regional, State and Federal Benefits

The proposed project will provide valuable information regarding the interaction between surface and groundwater. This information will facilitate a determination of how best to balance one area rich in both surface and groundwater supplies (Natomas) with a neighboring area of fewer surface supplies and a groundwater overdraft (Northeast Sacramento County). Increased conjunctive use within Natomas will provide additional water supplies for Natomas; however, the objective of the overall program reaches beyond the supplies available to Natomas and considers maximizing benefits to neighboring communities, and the overall system. Operation of multiple, comparatively small capacity sources (wells) will also equip Natomas with locally distributed sources throughout its distribution system, allowing for local introduction of water sources in response to real-time water demand based on irrigation scheduling, thus contributing toward overall increased irrigation efficiency. Due to Natomas' extensive reuse system, groundwater can be distributed throughout its conveyance system. This project is also an early precursor for an eventual connection between the Sacramento and American River systems, thus providing greater flexibility to agencies and local districts.

The proposed project could potentially assist the State and Federal agencies currently looking to expand conjunctive use throughout the state by answering the questions regarding the stream aquifer interconnection. This issue currently limits the State and Federal agencies from expanding or utilizing potential groundwater sources out of concern of pumping surface water supplies and thereby not creating new water.

The proposed project will fill a critical Bay-Delta need of improving in-stream flow in the Sacramento River. This Bay-Delta need is embodied in CALFED Quantifiable Objective 57. The water generated from the proposed project could be made available to critical needs downstream of the Delta and to Delta outflow. If the project proves successful identifying limited interconnection between the river and groundwater, this water could be made available far into the future by providing an alternate source of water for local needs.

In addition to this project providing valuable information as well as new water to the Delta, this project is also consistent with a regional plan. Several of the larger Sacramento River Settlement Contractors have been working cooperatively with the USBR and the DWR since 1997 in the development of the Sacramento River Basin-wide Management Plan (BWMP). Natomas has been an active participant in that process. Among the recommendations identified in the BWMP is to manage water among districts and ultimately other entities at a hydrologic sub-basin level. Management at this level would help optimize the efficient use of surface water and groundwater supplies and achieve the appropriate level of drain and return flow water use between water users located within a given sub-basin. This project provides the opportunity to help meet the increasing water supply and demands of Natomas, the Sacramento River and the Bay-Delta Estuary.

B-3 Quantifiable Objectives

While the objectives of this project would be to allow Natomas to more efficiently and effectively use its water supplies as stated above, it would also satisfy many of the quantifiable objectives. We believe the following quantifiable objectives would be improved by this project.

Environmental Benefits

The demonstration/test program will continue to provide water supply to the flood irrigation of thousands of acres of rice in Natomas, with the attendant wildlife habitat benefits. Further, the contribution of avoided surface water diversion from the river and Delta system, particularly in dry years, will enhance fish and wildlife habitat (CALFED Quantifiable Objective 57).

Added Delta Supply

The proposed project is designed to contribute increased surface flow in the Sacramento River past Natomas and flowing to the Delta. The direct benefit to the Delta may be a 1:1 increase in surface flow to the Delta for the full amount of groundwater pumped during dry years. In wet/normal years, there is some possibility that, since groundwater has been underdeveloped in Natomas, some regular use of groundwater could make available an increase in yield which could be transported to the Delta or held in storage upstream for subsequent addition to releases/stream flow in dry years.

Water Quality Improvement

Groundwater is generally recognized in the local area to have acceptable, but higher, concentrations of dissolved minerals. Thus, while there would be no anticipated degradation of water quality, and no constraints to continued land use and crop irrigation, the flow to the Delta would be benefitted during the period of avoided surface water diversion, while the flow to the Delta during any drainage from the rice fields to the river would logically have a slightly higher concentration of dissolved minerals. Concentrations of both benefits and impacts cannot be estimated until project quantities are finalized; preliminarily, it can be anticipated that any change will likely be measurable, if at all, in a few milligrams per liter.

B-4 Technical Feasibility

As introduced above, Natomas has historically relied almost exclusively on surface water diverted from the Sacramento River to meet the agricultural water requirements within its service area. Except for historical drought periods, (when some of the wells discussed in this application were constructed), there has been no widespread need to develop groundwater for irrigation water supply. There is, however, some nearby (immediately outside Natomas= service area) groundwater use, thus giving rise to the need to address potential third-party impacts caused by a conjunctive use pumping program as discussed herein.

Near Natomas, in a large part of northern Sacramento County immediately to the east of Natomas, there has been substantial historical pumping stress and a resultant progressive decline in groundwater levels on the order of 12 feet per year for about the last 50 years. Despite those conditions, which have a slight boundary effect in the southeastern part of Natomas, the historical lack of groundwater development in Natomas has resulted in long-term, relatively stable, high groundwater levels. Recognition of both conditions (high water levels and underdeveloped groundwater in Natomas; depressed water levels and overdraft east of Natomas) suggests that groundwater could be developed in Natomas and conjunctively used with ongoing historical diversions from the Sacramento River to achieve several objectives:

- Reduce dry year water demand from the Sacramento River.
- Achieve more efficient use of available water supplies.
- Increase Delta inflows.

- $ Ultimately, participate in a local regional solution to the northern Sacramento County overdraft problem.

In identifying the potential for development of a conjunctive use project to achieve the above objectives, Natomas also recognizes that similar opportunities, at least to increase dry year yield and increase Delta inflows, are available elsewhere in the Sacramento Valley. As a result, there is a great opportunity to increase overall yield via conjunctive use, and thus augment inflows to the Delta. At the same time, there is at least one major issue associated with prospective conjunctive use operations in close proximity to the Sacramento River and tributary streams: whether pumping intercepts surface water from the river by inducing infiltration in response to nearby groundwater pumping. Other issues include whether recharge will occur and how (purposeful artificial recharge vs. in-lieu recharge) to maintain the basin within its perennial yield, and whether third party impacts result from operations during pumping cycles. The question of in-lieu recharge, and the lack of need for purposeful artificial recharge facilities, has been studied and concluded by DWR in its investigation **American Basin Conjunctive Use Project**. Limited available data on the geologic configuration of the aquifer system and on the hydraulic characteristics of the aquifer materials limits the ability to directly address the other two issues: stream-aquifer connection, and third-party impacts. While there is sufficient available information to suggest that neither will be a significant impact, and thus will not fatally flaw potential conjunctive use, there is insufficient field verification at present to support firm conclusions to that effect.

As a consequence, Natomas proposes to initiate a pumping and test program to demonstrate conjunctive use (pumping) operations and to observe and analyze stream-aquifer interconnection and third party impacts. The ultimate intent, of course, is to devise appropriate mitigation measures for any substantial impact in order that third parties are made whole and pumping extracts Anew@ water, yielding an equivalent amount of Anew@ water in the river system by reducing Natomas= complete dependence on surface water diversions.

To investigate stream-aquifer connection and third party impacts, the Natomas work plan can be divided into three major parts. The first part will be a 2001 pumping test of approximately 5,000 AF to determine if existing facilities with proposed monitoring are sufficient for 2002 demonstration test, monitoring and analysis. The second part will be public outreach to receive input from local, State and Federal agencies through workshops to review 2001 test and review of 2002 monitoring and analysis of demonstration. The third part will be a 2002 demonstration of conjunctive use to monitor and analyze basin response, stream-aquifer connection, third party impacts and develop a final report made available to all local, State and Federal agencies. The CALFED Water Use Efficiency Grant Application Program can assist by funding the necessary demonstration and test program that will focus on monitoring and assessing actual conjunctive use operations using existing facilities. This would included the financial aspects of conducting such a demonstration and test which Natomas alone cannot afford.

The Natomas area overlies a layered aquifer system of several hundred to more than 1,000 feet of thickness; from youngest to oldest, the aquifer units include flood basin deposits and alluvium, generally near streams; the generally adjoining, shallow Modesto and Riverbank Formations, the widespread Turlock Lake and Laguna Formations, and the Mehrten Formation. Both the latter underlie the entire area. Unfortunately, much of the area is predominated by relatively deep, poorly drained soils which preclude application of the most commonly practiced form of artificial groundwater recharge, surface spreading. Despite that constraint, DWR concluded in its lengthy investigation and feasibility report on the **American Basin Conjunctive Use Project** that in-lieu recharge in its study area, which included Natomas and water districts immediately north, would effectively maintain the basin through dry and critical year groundwater pumping in the range of 37,000 to

67,000 AFY in Natomas. Based on that analysis, the demonstration and test level of proposed conjunctive use pumping, is expected to be recharged via in-lieu groundwater pumping reductions in subsequent or wetter years. Ultimately, as discussed herein, there is some possibility that a level of pumping greater than historic can be sustained to change normal to wet period yield, as well as augment dry year yield. Again, given the lack of historic regular groundwater pumping in Natomas, there is a reasonable possibility that this can be the case.

The dependence on in-lieu groundwater recharge precludes the need for dedicated recharge facilities, identified recharge water supply, and conveyance facilities to deliver water to the recharge facilities. The pumping of groundwater, on the other hand, can be readily accomplished to the level described in this project by using existing facilities. As introduced and discussed elsewhere and illustrated in Figure 1, Natomas has access to 13 wells with pumping capacities from about 1,140 gpm to about 3,500 gpm which can effectively discharge into the Natomas system, thus substituting for surface water diversions. Pertinent details about the existing wells are summarized in the following table.

Well #	Well	Pump Size (hp)	Pump Capacity (gpm)
1	Riego 2	100	2,100
2	Riego 8	200	3,500
3	Riego 9	30	800
4	Bianchi 1	60	2,000
5	Bianchi 2	80	2,000
6	Spangler	80	2,700
7	Morrison 1	40	1,000
8	Morrison 2	40	1,000
9	Morrison 3	40	1,000
10	Willey	40	1,500
11	Ose 1	150	3,000
12	Ose 2	200	3,000
13	Atkinson	80	2,500
Total			**26,100 gpm = 58 cfs**

The preceding pumping capacity equates to about 3,475 AF per month or, over an eight month rice pre-irrigation, irrigation and reflood period, approximately 20,000 AF of reduced surface water diversions from the Sacramento River.

The work plan for the 2001 test program will be comprised of pumping a network of existing wells to determine if proposed monitoring and analysis will be sufficient for 2002. This will allow for any minor modifications to facilities, monitoring or analysis proposed for 2002. The 2002 demonstration and test will comprise of pumping the same network of existing wells along with monitoring water level responses in the pumped wells and in other wells as available, conducting the equivalent of aquifer tests in two or more wells (near and distant from the river), surface and groundwater quality sampling and analyses, and river stage

monitoring. Basin response to pumping and in-lieu recharge will be interpreted through analysis of water levels and pumping volumes during and after the pumping cycles. Off-site or other third-party impacts will be assessed the same way, via measurement and interpretation of water levels with and without Aproject@ pumping, and with recognition to third-party pumping itself.

The analyses will include both time-related (hydrographs) and spatially related (contour maps) depictions of groundwater conditions. The stream-aquifer question will be technically analyzed by conducting the equivalent of constant rate pumping tests of selected wells near and distant from the river, while discharging the water into the distribution system for irrigation supply (i.e., as part of the conjunctive use demonstration). The water level draw down vesus time relationships will be analyzed to estimate the hydraulic characteristics of the aquifer and also to detect the hydraulic impact, or lack there of, of induced recharge effects of the river (i.e., to detect whether there is a direct hydraulic connection between the river and the aquifer materials in which the wells are completed). The water level analyses will be complemented by interpretation of surface and groundwater quality data for similarities, dissimilarities, and trends over the duration of an estimated eight-month pumping cycle.

The work plan includes interpretation of all the above in the context of the geologic setting and description of the aquifer system, with vertical superimposition of the pumping well completions, to test and cross-check the probable stream-aquifer relationship.

At the completion of the 2001 test a single report will be provided identifying the type of data that will be collected and provided for the 2002 demonstration and test. A workshop will be held at the end of 2001 inviting local, State and Federal agencies to review and discuss the 2001 results and possible modifications (depending on costs) to the 2002 demonstration and test. For the planned duration of the 2002 demonstration and test, quarterly reports will address the starting of the test, the completion of the test, the post-test basin response, and analysis of impacts. These reports will be provided to all local, State and Federal agencies that have an interest in the outcome. Natomas anticipates that a successful ongoing conjunctive use program will evolve from the demonstration and test program.

B-5 Schedule

The chart below identifies the approximate schedule for the proposed project. The schedule includes some work that has been previously completed. Natomas met on a regular basis with DWR, some State Contractors and other local agencies discussing such a project as the one described here. Those efforts provided valuable insight into the overall project and established communication between parties and were done at Natomas' expense. Correspondence and a meeting with the USBR was also facilitated by Natomas to discuss this project in April of 2000. This also provided information as to the goals and objectives of the USBR which have been addressed in the proposed project. Natomas intends to begin additional public outreach prior to CALFED awarding the grant in order to begin the project at the earliest time possible. The timelines projected in the chart are estimates at this time that could vary greatly depending on the timing of CALFED awarding the grant.

Chart of Schedule

This chart is provided in the hard copies. The graphic of the chart could not fit on 3.5 inch floppy disk restriction.

B-6 Monitoring and Assessment

As described above, the proposed 2001 test and the 2002 demonstration and test program will provide monitoring and status reports. These reports will include the initiation of the project, status during a first irrigation season of pumping, monitoring and testing, post-pumping monitoring of basin recovery and in-lieu recharge, and interpretation analysis of benefits and impacts of the pumping and testing. As also described above, the 2001 test and 2002 demonstration and test program will involve a mixture of focused well and aquifer testing to investigate stream-aquifer connection (or separation), plus less rigorous Aroutine@ surface and groundwater monitoring. The approximate locations of program wells are illustrated in Figure 1. Idle wells near some of the project wells will be used, as feasible, in conjunction with the pumped wells for monitoring aquifer test and/or basin response. Nearby, potentially impacted third-party wells have not yet been identified, but would be located prior to the start of demonstration and test pumping operations. These wells will be monitored on a regular basis, depending on distance from project wells.

ATested@ wells and any nearby observation wells would be observed (capacity, cumulative volume, water levels) on a varying frequency as the tests progress, from every minute to every hour or longer, consistent with standard aquifer testing protocol, to allow appropriate interpretation in accordance with confined, unconfined, or leaky aquifer theory.

Land subsidence is not considered to be a likely issue at the scale of the proposed demonstration and test. However, depending on the findings and any plans for ongoing conjunctive use, appropriate monitoring of subsidence, likely via interpretation of ongoing subsidence monitoring at the Sutter extensometer, will be added to ongoing monitoring. Whether that is limited to land surveying, incorporation of existing extensometer monitoring, or ultimate construction of a new extensometer is unknown at present but would be factored into evaluation of the demonstration and test.

C-1 - C-4 Local Support and Outreach

The proposed project is in full compliance with general plans and/or regional agreements and has the support of local constituencies. The project is proposed in the context of the Sacramento Region=s *Water Forums Agreements*, of which Natomas is a signatory, as well as the Sacramento North Area Groundwater Management Authority (ASNAGMA@) and a locally constituted AB3030 Groundwater Management Plan. The *Water Forums Agreements*, signed by over 50 participating entities, specifically encourages and authorizes increased conjunctive use of surface and groundwater resources. The agreements anticipate and support projects such as described in this application. In addition, Natomas is a governing member of SNAGMA, the newly constituted public agency charged with protection of the groundwater basin north of the American River and east of the Sacramento River. Natomas is actively cooperating with SNAGMA, as well as the American River Basin Cooperating Agencies (AARBCA@) to find ways to preserve local surface water rights, expand conjunctive use to increase local water supply, particularly dry-year yield, and provide incentives for preserving groundwater supplies. The county of origin for this project, Sacramento County, is also a governing member of SNAGMA. Sutter and Placer Counties are being considered for membership in

SNAGMA during FY2001 as well. This proposal would try to blend with any SNAGMA objectives in order to prevent duplicative efforts. Finally, the project would be consistent with the wishes of local landowners through the AB3030 plan as proposed by Natomas and Reclamation District 1000, which is charged with blending the immediate landowner objectives of preserving groundwater supplies with that of the groundwater initiatives of regional entities through the vehicle of SNAGMA. Additional local public outreach would be made to surrounding communities such as the City of Rio Linda, the City of Sacramento, Reclamation District 1001, Pleasant Grove Verona Irrigation District and South Sutter Water District. This public outreach will be in the form of an invitation to attend a presentation on the proposal explaining the local and potential statewide benefits. Additional presentations will be considered prior to July of 2001 in order to receive the widest possible support. The proposal anticipates wide local support in order to learn more about the region=s resources and how best to manage them for both local and state-wide benefits. As stated above, additional workshops would be held during and after the demonstration and test to receive input from all local, State and Federal agencies regarding the monitoring and analysis.

Natomas has worked closely with DWR's groundwater division in the past with regards to the American Basin Conjunctive Use Report. DWR staff agreed that this type of project would be necessary to allow a full American Basin Conjunctive Use to move forward. Natomas has also met with USBR in the past regarding this type of project and has included as part of this analysis to address the USBR's primary concern of interconnectivity with the river. Natomas would work closely with these agencies to discuss the results of the groundwater pumping and receive input from them. Natomas would maintain flexibility within the cost of the project to adjust the test to help answer questions as they arise.

D-1 Qualifications of Applicants

Attached are the resumes of Joe Scalmanini, Scott Heule, Marc Van Camp, Gary Kienlen and Tom Hickmann. Joe Scalmanini would be the project manager with Scott Heule conducting the data gathering and preliminary analysis. Marc Van Camp, Gary Kienlen and Tom Hickmann would assist in reviewing the data, provide assistance on report writing, data gathering or any regulatory issues that may arise.

D-2 Role of External Cooperators

The USBR, DWR, SNAGMA, ARBCA, Sacramento County, Sutter County, RD 1000, RD 1001, the City of Rio Linda, the City of Sacramento, Pleasant Grove Verona Irrigation District and South Sutter Water District would all be asked to provide technical input through workshops. As stated above, this input would be used to modify the demonstration and test to provide the most valuable results.

D-3 Partnerships

Natomas has participated in the extensive discussions that have led to the draft Sacramento Valley Settlement Agreement currently being considered by the SWRCB in Phase 8 of the Bay-Delta hearings. This Settlement Agreement forms a partnership between Sacramento Valley water right holders, including Natomas, water users within the export areas, DWR, and Reclamation that has never been achieved to this magnitude in history. The Settlement Agreement recognizes the need to increase the overall water supplies available to all

water users throughout the state and that a cooperative approach is the most effective means to meet this need. The Settlement Agreement and associated projects must be pursued in unison with CALFED goals, objectives and program. The proposed Natomas project requested for funding under this grant application is a project that meets the common goals of the Settlement Agreement and CALFED.

E-1 - E-2 Proposed Itemized Budget and Budget Justification

The Natomas Conjunctive Use Project is a two-part project comprised of a test component in 2001 and a demonstration and test in 2002. The demonstration and test component focus on assessing basin response to pumping, in light of the historical absence of groundwater pumping in Natomas (and the essentially exclusive dependance on surface water), investigation, analysis, and mitigation as necessary of river-aquifer interconnection, and whether pumping would induce recharge from the river (i.e., pumping of Aproject@ water) and thus, not really add new water to the system. The subsequent ongoing practice of conjunctive use is intended to replace, at a minimum, some dry year diversion of surface water to increase system-wide yield, and to a lesser extent in wet and normal years. Generally estimated budget requirements for both components, including both capital and operating costs, are shown on the budget in the attachments.

E-3 Quantifiable Outcomes

As stated previously, the expected project outcomes and benefits are a decrease in surface water diversions in the Sacramento River and more efficient use of available water supplies. In the first year the project is expected to produce an additional 20,000 AF of new water improving flows, water quality and overall system supplies. In Dry and Critical years it is estimated that this would be a 1:1 exchange in the quantity of new water. The water quality benefit can only be qualitatively stated at this time. The results of the first year are anticipated to answer the current unanswered question regarding the interconnection between the stream aquifer which could lead to a larger scale conjunctive use program. If a modest program of conjunctively exchanging groundwater for surface water helps both the river systems as well as the aquifer, the local and potentially statewide benefits would be invaluable.

TH/mv
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Map of Well Location and District Boundaries

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Attachments

RESUME

Joseph C. Scalmanini

Specialization:

Thirty-three years of experience in ground_water development and management, and oil and gas production. Assessments of ground_water resources and implementation of ground-water basin management in various areas of California; ground_water development and management encompassing well design, construction, operation, and maintenance; ground-water monitoring as part of basin management and as part of ground-water contamination investigations; artificial ground_water recharge facilities and practices; injection of industrial waste water; utilization of brackish ground water for industrial water supply and cooling applications. Industrial design, construction and operation of secondary oil recovery systems involving water and steam processing, injection and recovery.

Professional Registration:

Registered Civil Engineer, California, CE 28233

Academic Degrees:

M.E. Civil Engineering, University of California, Davis, CA	1984
B.S. Mechanical Engineering, University of Santa Clara, Santa Clara, CA	1967

Professional Experience:

Luhdorff and Scalmanini, Consulting Engineers, Woodland, CA Partner	1980 to Present
University of California, Davis, Davis, CA Associate Development Engineer	1973 - 1979
Shell Oil Company Mechanical and Facilities Engineer	1967 - 1973

Representative Professional Assignments:

- Consultant to water districts and utilities, municipalities, corporate and individual farming interests, corporate and private industry, and other engineering firms on ground_water development, utilization and management. Consultation with public agencies, corporate and private concerns regarding ground_water contamination, its identification, monitoring, and management. Consultation with legal profession on technical aspects of ground_water development and utilization, including well design and construction and application of pumping equipment.

Representative Professional Assignments (continued):

- Engineering research in ground_water resources, development and management. Coordinated and conducted engineering projects concerning assessment of ground_water resources in various areas of California including mountainous and valley regions; application of principles of design, construction, completion and development of wells, aquifer analyses, design of pumping equipment, optimal and efficient operation of wells and pumps, and well rehabilitation and maintenance; design of artificial ground_water recharge facilities and practices, including surface infiltration and deep_well injection; assessment and development of brackish ground_water for water supply and cooling applications in industrial plants. Provided consultation services to engineering firms; local, state and federal agencies, corporate and private industry and farming interests, and well contractors on the development and management of ground_water resources.

- Project Engineer on water treatment, injection, and recovery systems for secondary oil recovery in Southern California oil fields; project engineer for the design and installation of facilities and utilities in a new oil field development in Central California; design engineer on various pumping and piping applications of water, oil, gas and other compressible fluids.

Professional Affiliations:

American Society of Civil Engineers
- _ Ground Water Committee, Irrigation and Drainage Division
- _ Water Resources Planning Committee, Water Resources Planning and Management Division

National Ground Water Association
- Association of Ground Water Scientists and Engineers

American Water Works Association
National Society of Professional Engineers
California Groundwater Association
Groundwater Resources Association of California

Public Service:

- **Yolo County Aggregate Resources Committee (1975_79)**, Alternate delegate, hydrologist _ analysis of impacts and development of management plans for extraction of aggregate from Cache Creek basin.

- **California Tenth Biennial Conference on Ground Water (1975)**, Member, Planning Committee

- **Chancellor's Campus (Univ. of Calif., Davis) Water Committee (1976_78)**, Staff Engineer _ analysis of water supplies and uses, projection of requirements, development of conservation and management plans.

- **City of Davis Water Planning and Conservation Committee (1977_79)**, Chairman _ analysis of water supplies and uses, projection of requirements, consideration of alternative supplies, development of conservation and management plans.

- **Yolo County Water Resources Task Force (1979)**, Member _ development of county_wide master water plan.

Public Service (continued):

- **Pacific Gas and Electric Co. ACT^2 Irrigation Pumping Demonstration Project (1992)**, Technical Advisor

- **Association of California Water Agencies (1994-1996)**, Member - Ground-Water Committee

- **Cache Creek Conservancy**, **(2000-)**, Director

Teaching Activities:

Course Coordinator and Instructor University Extension Courses, University of California, Davis:

Concepts of Ground Water Management (1974, 1976, 1978, 1981)
Legal and Policy Considerations in Ground Water Management (1975, 1976, 1980)
Water Supply Wells and Pumps (1977, 1978,1981, 1983, 1985, 1986)

Instructor, University of California, Davis, Water Science 198, Introductory Hydraulics (1977, 1978, 1979)

Lecturer, University of California, Davis, Water Science 2, 140, 160; Ecology 230; Civil Engineering / Geology 175.

Lecturer on Aquifer Characteristics, Well Hydraulics, and Ground-Water Development, in Technical Training Classes at the U.S. Army Corps of Engineers' Hydraulic Engineering Center, Davis, CA.

Publications and Presentations:

Scott, V.H. and J.C. Scalmanini, **Water Wells and Pumps: Their Design, Construction, Operation, and Maintenance**, University of California Division of Agricultural Sciences Bulletin No. 1889, 1977.

Helweg, O.J., Scott, V.H., and J.C. Scalmanini, **Improving Well and Pump Efficiency**, American Water Works Association, 1983.

Scalmanini, J.C., and Scott V.H., **Design and Operational Criteria for Artificial Groundwater Recharge Facilities**, Water Science and Engineering Paper No. 2009, University of California, Davis, 1979.

Scalmanini, J.C., Scott, V.H., and O.J. Helweg, **Energy and Efficiency in Wells and Pumps**, presented at Twelfth Biennial Ground Water Conference, 1979.

Scalmanini, J.C., Johnson Jr., R.M., and E.E. Luhdorff Jr., **Development of a Ground-Water Monitoring Program as a Basis for Coastal Ground-Water Basin Management**, presented at the Fall Conference, American Water Works Association, CA-NV Section, 1983.

Scalmanini, J.C., **3030 Hindsight and 2020 Foresight, Actual Ground-Water Management Experience**
Over the Last 15 Years, Soquel Creek Water District, presented at the Association of California Water Agencies' Ground-Water Management Conference, March 1994.

Publications and Presentations (continued):

Scalmanini, J.C., **Legal and Technical Issues Related to Surface Water and Ground-Water Interaction**, presented at the Groundwater Resources Association's California Ground Water & Efficient Usage for the Year 2000 and Beyond, October 1998.

Scalmanini, J.C., **What the Heck's a Sub-Basin? Defining Basins and Sub-Basins**, presented at the Association of California Water Agencies' Ground-Water Management: Will CalFed Help or Hinder Workshop, November 2000.

RESUME

Scott D. Heule

Specialization:

Twenty-two years of experience investigating ground water resources availability, occurrence, and movement, ground water issues associated with engineering geology, and ground water quality characterization throughout California and Oregon.

Professional Registration:

California, Certified Engineering Geologist, EG 1173
California, Certified Hydrogeologist, HG 143
California, Registered Geologist, RG 3799
Oregon, Engineering Geologist, EG 1515

Academic Degrees:

B.A. Earth Science, California State University, Fullerton, CA 1977

Professional Experience:

Luhdorff & Scalmanini, Consulting Engineers, Woodland, CA April 1999 - Present
Senior Hydrogeologist

EMCON, San Bernardino, CA 1996 - 1999
Senior Hydrogeologist

Scott Heule & Associates, Consulting Hydrogeology, Big Bear Lake, CA 1989 - 1996
Principal Hydrogeologist

David J. Newton Associates, Inc., Portland, OR 1993 - 1994
Senior Hydrogeologist

Ron Barto Ground Water Consultants, Big Bear Lake, CA 1989
Managing Hydrogeologist

Leighton and Associates, Inc., Riverside, CA 1988 - 1989
Senior Hydrogeologist

Professional Experience: (continued)

Fluor-Daniel Inc., Irvine, CA 1988
Project Hydrogeologist

Ron Barto & Associates Consulting Hydrogeologists, Big Bear Lake, CA 1984 - 1988
Supervising Hydrogeologist

Leighton and Associates, Inc., San Diego, CA 1978 - 1984
Senior Hydrogeologist, Ground Water Resources Division Manager

Robert C. Fox, Fullerton, CA 1977 - 1978
Hydrogeologist

Representative Professional Assignments:

- Eagle Crest II, Redmond, Deschutes County, OR. This project required analysis of long term pumping impacts for golf course irrigation well production. The work included estimation of aquifer hydraulic characteristics, preparation of a conceptual model of the exceptionally permeable basalt source aquifer, and comparison to a previous short term pumping test. Also associated with this work was an evaluation of potential for streamflow depletion resulting from the project irrigation demands.

- Hydrogeologic Evaluation for Spring Water Development, Skyforest, San Bernardino County, CA. The Skyforest Mutual Water Company desired to wholesale "spring" water to a local bottler from a series of horizontal wells drilled into the steep, south facing escarpment of the San Bernardino Mountains. The 120-acres occupied by the horizontal wells reaches nearly to the top of the drainage divide along the ridgline. Three different methods were utilized to estimate the perennial yield from the "springs" including; evaluation of actual long term use and aquifer response in an adjoining subarea, projections based on computer modeling of rainfall, runoff, soil moisture and evapotranspiration, and a USGS method of recoverable water in mountain basins. Results indicated suitable annual extraction rates of up to 30 AF and the EIR for the project is currently being appealed to the Board of Supervisors due to local citizen opposition to the proposed export.

- Ground Water Resources and Management Plan, Stallion Oaks Ranch, Descanso, East San Diego County, CA. A proposed 193 acre RV resort expansion required additional ground water to satisfy additional domestic water demands. Hydrogeologic studies evaluated ground water recharge and storage in a crystalline rock aquifer. Further evaluations involved ground water quality impact analysis of commercial septic system wastewater disposal. Surficial geologic mapping, subsurface mapping to define alluvial storage areas, a 48-hour pumping test with several observation wells were all part of this work.

- Ground Water Resources Evaluation and Management Plan, Steele Canyon Resort and Golf Club, Jamul, San Diego County, CA An existing 665 acre golf and country club uses imported irrigation water to meet demands of a 27-hole golf course and other non-potable uses. Ground water occurs in both alluvial and crystalline bedrock aquifers, and a portion of the imported irrigation supply is proposed to be supplanted by local ground water. Two 30-day pumping tests were conducted, while monitoring several observation wells with pressure transducers and dataloggers. Other analysis included estimates of long term recharge and ground water storage available to the project. Results of the study indicated a possible 120 AF available to partially satisfy the total demand of more than 400 AF annually.

- Shadow Rock Golf Course Resort, Palm Springs, Riverside County, CA. Hydrogeologic analysis was completed on this 1200-acre property adjacent to the San Jacinto Wilderness area, a unique spring fed cienega and other physiographic features important to local Native Americans. The proposed use of onsite irrigation wells, pesticides associated with the golf course and urban runoff pollution were important considerations in the evaluation of potential ground water quality impacts. After preparing water budget summaries for the proposed project and alternatives, a capture zone analysis was completed to evaluate pumping impacts on the cienega and designed pesticide use BMP's to avoid ground water quality impacts. Mass balance type analysis was completed to evaluate nitrate and total dissolved solids impacts and mitigation measures, such as aquifer testing, and water level monitoring were prepared. Other BMP's were prepared to address concerns with construction storm water management.

- Groundwater Resources Development and Management Plan, High Meadow Ranch, Golf Course and Residential Development, San Diego County, CA. Principal issues associated with this 1,200-acre golf course resort in San Diego's back county included availability of groundwater supplies to augment imported irrigation demands and potential impacts to numerous adjacent private domestic water wells. The challenges facing this project were compounded because the site was located in crystalline bedrock terrain with limited groundwater storage, but typically sufficient annual recharge to meet the groundwater supply objective. Four new well sites were selected using remote sensing techniques, and a strategically placed monitoring well was sited between the development and it's neighbors using borehole video logging and geologic structural analysis. After defining the potential impacts to the adjacent landowners, mitigation measures were designed that included artificial recharge in the overlying residuum of three subbasins with excess winter runoff, and design of a less irrigation intensive links type golf course.

***Professional Affiliations**:*

Geological society of American, Hydrogeology Division and Inland Geological society

EDUCATION

, California State University, Sacramento
BS in Civil Engineering, 1984

PROFESSIONAL LICENSES AND SOCIETIES

, Registered Civil Engineer in California
, Registered Civil Engineer in Nevada
, Registered Civil Engineer in Oregon
, Certified Water Right Examiner in Oregon
, Member, American Society of Civil Engineers

EXPERIENCE

1990 - Present MBK Engineers, Sacramento, CA
Principal
Same experience as described below with greater emphasis on the management and supervisory role.

1984 - 1989 MBK Engineers, Sacramento, CA
Consulting Civil Engineer
Practice in the fields of hydrology, hydraulics, irrigation, drainage, groundwater, water supply, water rights, project feasibility and related problems.

Major thru-Delta Water Transfers. Included obtaining regulatory approval, scheduling of releases and delivery, contract negotiation and monitoring of water right changes.
Licensing of Nevada Irrigation District's appropriative water rights. Included detailed analysis of water use to license 1920 appropriative water rights for a complicated water supply system. Involved many sessions with State Water Resources Control Board staff to relate water use analysis to water rights held by the District, including its pre-1914 rights.

Water Supply Contract Negotiations with US Bureau of Reclamation. Analysis and presentation of potential water right yields to arrive at project/contract quantities.

Water Right Dispute Settlements. Gathering of factual data to settle water right issues in lieu of legal proceedings.

Expert Witness. Testify as expert witness in water right hearings and court cases.

1979 - 1984 US Geological Survey, Sacramento, CA
Engineer Technician
Duties included surveying, hydrologic basic data collection and analysis.

CONTINUING EDUCATION SEMINARS and WORKSHOPS

- Flood Fight Methods, California Department of Water Resources, 1984.
- Water Systems Management Workshop, US Bureau of Reclamation, 1988 and 1994.
- California Water Law, University of California Extension, U.C. Davis, 1989.
- Irrigation System Evaluation Short Course, DWR and Cal Poly, San Luis Obispo.
- Flow Measurement, Control and Monitoring Workshop, USBR, DWR and Cal Poly, San Luis Obispo.

TOM HICKMANN

EDUCATION

, California State University Sacramento
BS in Civil Engineering, 1996

PROFESSIONAL LICENSES AND SOCIETIES

, Registered Civil Engineer in California
, Registered Civil Engineer in Oregon
, Member, American Society of Civil Engineers

EXPERIENCE

1996 - Present MBK Engineers, Sacramento, CA
Civil Engineer
Specialize in water rights and water supply analysis. Calculate water use, needs and conservation for large and small irrigation projects. Suggest and oversee modification to irrigation systems. Complete and submit various applications to obtain water rights and changes of water rights with the State Water Resources Control Board. Perform extensive research of water rights, corresponding boundaries and historical quantities from records at Division of Water Rights and Bureau of Land Management. Perform water measurements on streams and canals to determine flows, losses and develop rating curves. Analyze water systems to determine capacities and quantities from various supplies. Obtain permits from US Army Corps and Reclamation Board for installation of pumping plants and measuring facilities along waterways and through levees. Assist in the development and submittal of claims filed in the Klamath River adjudication which required the determination of water needs for over 175,000 acres of irrigated lands. Determine reservoir size, capacities and layout of small reservoirs. Advise clients of potential water supply impacts from regulations imposed by state and federal agencies. Run level surveys of levees to determine land subsidence and water elevations during flood events. Develop groundwater contours and reports of groundwater conditions. Prepare water management plans for irrigation districts. Advise clients on water quality issues.

1995 - 1996 Sacramento Regional Wastewater Treatment Plant, Sacramento, CA
Engineering Student Trainee, Level II
Assisted senior engineer with the development and feasibility of producing a biosolids usage program. Performed public educational presentations, and aided in the development of a five-acre land demonstration on the use and application of biosolids on agricultural crops. Monitored soils for heavy metals to ensure compliance of EPA 503 regulations. Assisted two associate engineers in development of heat drying and composting to produce a biosolids fertilizer product.

CONTINUING EDUCATION SEMINARS and WORKSHOPS

, Irrigation Drainage, Efficiency, Evaluation, Water Conservation and Water Balances, California Polytechnic University, 1997, 1998, 2000.
, Water Management, US Bureau of Reclamation, Denver, CO, 1998.

, Flood Fight Methods, California Department of Water Resources, Sacramento, CA, 1998.

EDUCATION

, American River College, Sacramento, CA
AA in Math and Science, 1991

PROFESSIONAL LICENSES and SOCIETIES

, Registered Civil Engineer in California, C59041
, Registered Professional Engineer in Oregon, 62730PE
, Certified Water Right Examiner in Oregon, 62730WRE
, Associate Member, American Society of Engineers
, Member, Professional Engineers of Oregon

EXPERIENCE

03/99 - Present MBK Engineers, Sacramento, California
Civil Engineer
Same experience as described below with greater independence and discretion.

04/88 - 03/99 MBK Engineers, Sacramento, California
Engineering Associate and Water Resources Technician
Practice in the fields of water rights, water supply, irrigation, drainage, hydrology, hydrography, hydraulics, project feasibility and related problems.

Water Rights: Preparation of water right applications and change petitions together with associated maps and related documentation for various project types and sizes. Conduct detailed analysis of water use for the purpose of obtaining water right licenses. Investigation and determination of appropriative, pre-1914 and riparian water rights.

Water Supply: Analysis of water demands for project use, evaporation losses and other factors limiting available water supply. Preparation of reservoir operation studies. Development of procedures for determining capacities, losses and depletions for irrigation districts, watersheds and drainage basins. Design, rating, and supervision of the installation of new, and evaluation of existing, water control structures and measuring devices for both natural and man-made channels. Evaluation of irrigation facilities, including diversion structures, pipelines, and associated works, as well as the review of shop drawings and supervision of construction. Evaluation of impacts of water control and diversion facilities on fish passage. Preparation of water conservation plans and groundwater management plans for compliance with state and federal regulations.

Flood Control: Party chief for surveys of Delta Islands, including the identification of all facilities and inspection of physical characteristics affecting the integrity of the levee system. Preparation of reports for submittal to FEMA. Gather, establish and document data during and after flood events for the purpose of determining flows, water surface elevations and the extent of the associated flooding. Evaluation of methods and costs associated with flood events.

Prior to 1988 MBK Engineers, Sacramento, California

Engineering Aide
Conducted (intermittent) field and hydrographic surveys and related office work.

CONTINUING EDUCATION, SEMINARS and WORKSHOPS

- Water Systems Management Workshop, 1989, U.S. Bureau of Reclamation
- Flood Fight Methods, 1989, California Department of Water Resources
- Irrigation System Evaluation Short Course, 1993, California Department of Water Resources and Cal Poly, San Luis Obispo
- Flow Measurement Control and Monitoring Workshop, 1993, U.S. Bureau of Reclamation, California Department of Water Resources and Cal Poly, San Luis Obispo
- Flow Measurement, Control and Monitoring Workshop, 1995, U.S. Bureau of Reclamation, California Department of Water Resources and Cal Poly, San Luis Obispo
- Water Conservation Coordinator Workshop, 1998, U.S. Bureau of Reclamation, California Department of Water Resources and Cal Poly, San Luis Obispo

E-1 - E-2 Proposed Itemized Budget and Budget Justification

Item	Amount	Units	Qty	Total Cost	Units	Life (years)	Present Value	Local Share($)	CALFED Request($)
a. Salaries and Wages									
Administration (Includes costs for district personnel to develop conjunctive use program and grant application.)	50,000	$/yr	1	50,000	$/yr	4	50,000	50,000	0

Administration (Includes costs for district personnel to administer and monitor the conjunctive use program.)	15,000	$/yr	3	45,000	$/yr	3	45,000	45,000	0
b. Fringe Benefits	None – no indirect cost associated with this project								
c. Supplies									
*Power supply (Estimated cost for PG&E power to pump or cost of portable generators to pump.)	625,000	$	1	625,000	$	2	625,000	0	625,000
Conveyance Cost (Includes incentive cost for landowners to participate by providing use of well.)	200,000	$	1	200,000	$	2	200,000	0	200,000
d. Equipment	Pumps and related equipment included in **Item g.**								
e. Services or consultants									
Consultants (Includes cost for consultants to attend meetings for public outreach and review reports)	10,000	$	1	10,000	$	2	10,000	10,000	0
f. Travel	None								
g. other direct costs including planning, design, construction, maintenance, etc									
Well Modifications (Includes purchase and installation of meters and pipe discharge modifications)	30,000	$	1	30,000	$	30	30,000	0	30,000
Site Acquisition	0	$	0	0	$	0	0	0	0
Site Improvements	0	$	0	0	$	0	0	0	0

Continued on next page

Item	Amount	Units	Qty	Total Cost	Units	Life (years)	Present Value	Local Share($)	CALFED Request($)
Engineering (Includes costs for reviewing and evaluating well sites, overseeing well modifications, monitoring, testing, analysis and reporting.)	110,000	$	1	110,000	$	3	110,000	10,000	100,000

Legal (Includes costs for well owner and funding agreements)	5,000	$	1	5,000	$	3	5,000	5,000	0
Mitigation Fund	50,000	$	1	50,000	$	3	50,000	0	50,000
h. Total Estimated Costs; total items(a through g)							**1,125,000**	**120,000**	**1,005,000**
*Power costs are extremely volatile this year and therefore the figures in this table are estimates based on historical cost to pump groundwater of $25/AF. This volatility can be accounted for in either the volume of water or contract amount at a future date.									